LAB Logbook

Lab 1

Lab Logbook Requirement:

1) Create a vector using np.arange.

Determine the number of the vector elements using the following method: Take the last two digits from your SID. It should be from 00 to 99. If this number is 10 or more, it becomes the required number of the vector elements. If it is less than 10, add 100 to your number.

For example, if your SID is 2287467, and the last two digits are 67, which is greater than 10. The required number is 67. If your SID is 2287407, and the last two digits are 07, which is less than 10. The required number is 107.

Then,

2. Change matrix a to 2-d array with 1 row. Print the array. You should have the two sets of brackets for a 2-d array with one row.
3. Save it in another array. Print the array.
4. Check the shape attribute value.
5. Add the code and result to your Lab Logbook

NOTE: DON'T FORGET TO SAVE AND BACK UP YOUR COMPLETED JUPYTER NOTEBOOK AND LAB LOGBOOK ON GITHUB OR ONEDRIVE.

In [69]:
```
SID = 2285050
```

In [72]:
```
number_of_vector_elements = 50
vector = np.arange(number_of_vector_elements)
print("Vector: ", vector)
```

```
Vector:  [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
 48 49]
```

In [73]:
```
_2d_array = vector.reshape(1, -1)
print("2D array with one row: ", _2d_array)
```

```
2D array with one row:  [[ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
  24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
  48 49]]
```

In [74]:
```
another_array = _2d_array.copy()
print("Another array: ", another_array)
```

```
Another array:  [[ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
  24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
  48 49]]
```

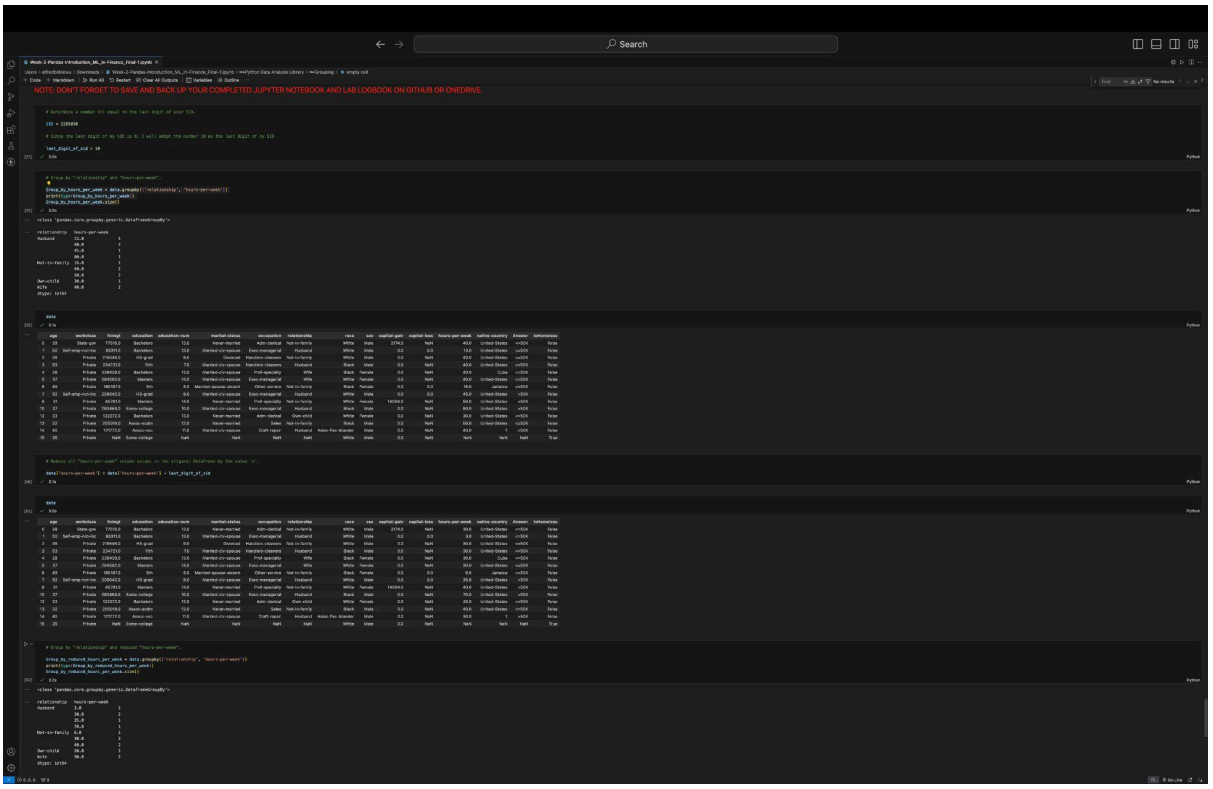
In [75]:
```
shape_value = another_array.shape
print("Shape: ", shape_value)
```

```
Shape:  (1, 50)
```

In [ ]:
```

```

Lab 2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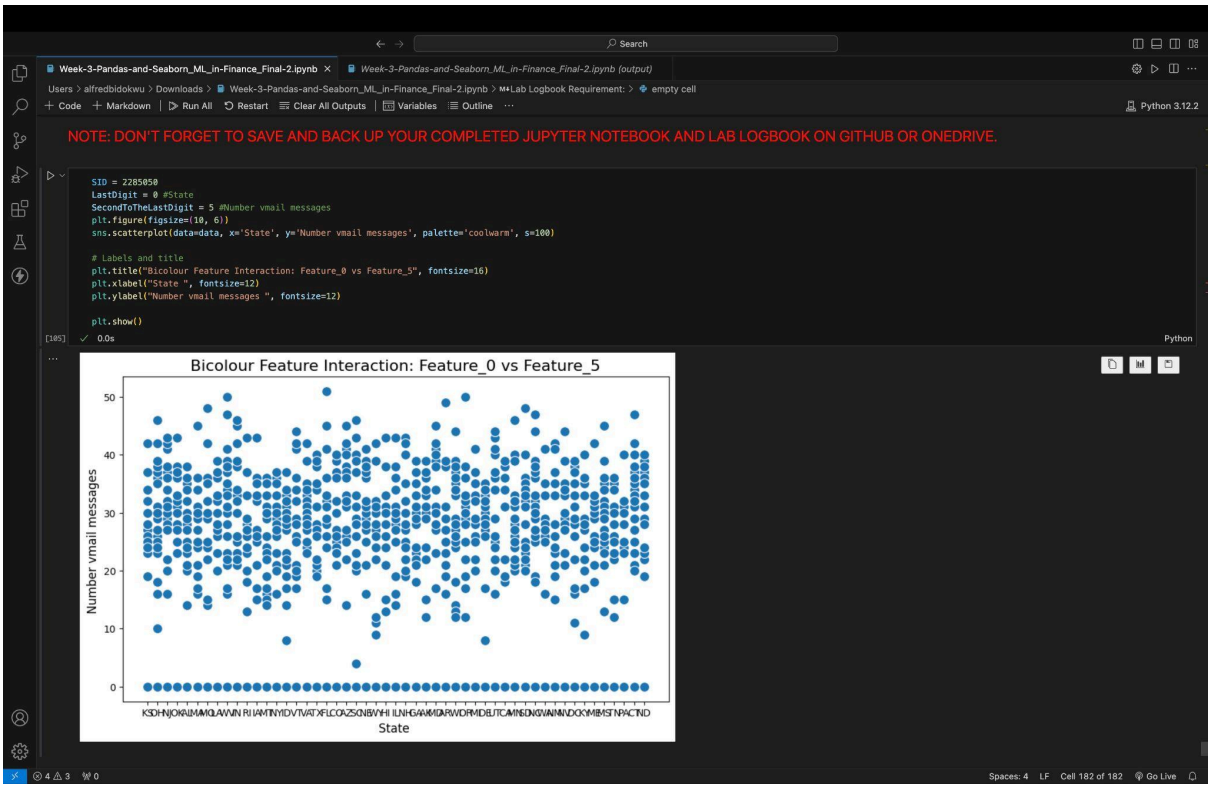
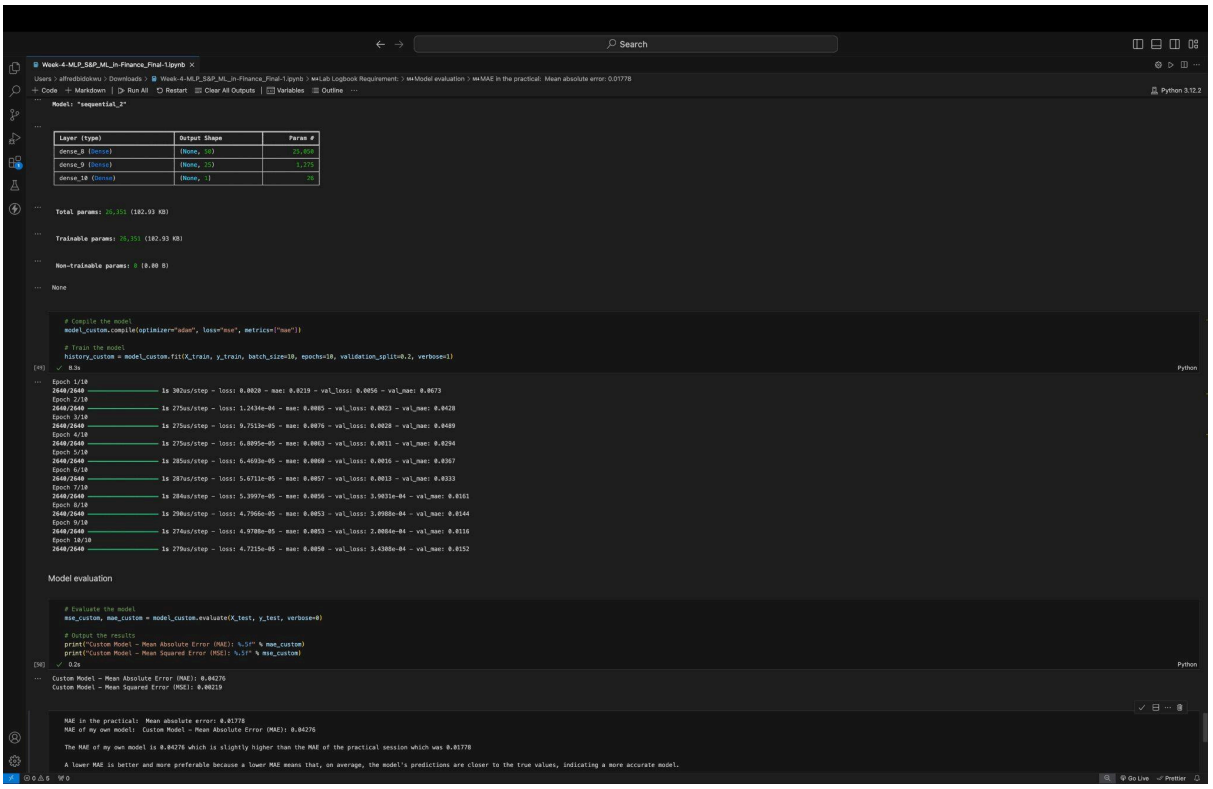
Lab 3


NOTE: DON'T FORGET TO SAVE AND BACK UP YOUR COMPLETED JUPYTER NOTEBOOK AND LAB LOGBOOK ON GITHUB OR ONEDRIVE.
SID = 2285050
LastDigit = 0 #State
SecondToTheLastDigit = 5 #Number vmail messages
plt.figure(figsize=(10, 6))
sns.scatterplot(data=data, x='State', y='Number vmail messages', palette='coolwarm', s=100)
# Labels and title
plt.title("Bicolour Feature Interaction: Feature_0 vs Feature_5", fontsize=16)
plt.xlabel("State ", fontsize=12)
plt.ylabel("Number vmail messages ", fontsize=12)
plt.show()
Bicolour Feature Interaction: Feature_0 vs Feature_5
Number vmail messages
State

Lab 4



Model: "sequential_2"

Layer (type)	Output Shape	Param #
dense_8 (Dense)	(None, 50)	25,050
dense_9 (Dense)	(None, 25)	1,275
dense_10 (Dense)	(None, 1)	26

Total params: 26,351 (102.93 KB)

Trainable params: 26,351 (102.93 KB)

Non-trainable params: 0 (0.00 B)

None

```
# Compile the model
model_custom.compile(optimizer="adam", loss="mse", metrics=["mae"])

# Train the model
history_custom = model_custom.fit(X_train, y_train, batch_size=10, epochs=10, validation_split=0.2, verbose=1)
```

[45] 8.3s Python

```
Epoch 1/10
2640/2640 ━━━━━━━━━━━━━━━━━━━━ 1s 302us/step - loss: 0.0020 - mae: 0.0219 - val_loss: 0.0056 - val_mae: 0.0673
Epoch 2/10
2640/2640 ━━━━━━━━━━━━━━━━━━━━ 1s 275us/step - loss: 1.2434e-04 - mae: 0.0085 - val_loss: 0.0023 - val_mae: 0.0428
Epoch 3/10
2640/2640 ━━━━━━━━━━━━━━━━━━━━ 1s 275us/step - loss: 9.7513e-05 - mae: 0.0076 - val_loss: 0.0028 - val_mae: 0.0489
Epoch 4/10
2640/2640 ━━━━━━━━━━━━━━━━━━━━ 1s 275us/step - loss: 6.8095e-05 - mae: 0.0063 - val_loss: 0.0011 - val_mae: 0.0294
Epoch 5/10
2640/2640 ━━━━━━━━━━━━━━━━━━━━ 1s 285us/step - loss: 6.4693e-05 - mae: 0.0060 - val_loss: 0.0016 - val_mae: 0.0367
Epoch 6/10
2640/2640 ━━━━━━━━━━━━━━━━━━━━ 1s 287us/step - loss: 5.6711e-05 - mae: 0.0057 - val_loss: 0.0013 - val_mae: 0.0333
Epoch 7/10
2640/2640 ━━━━━━━━━━━━━━━━━━━━ 1s 284us/step - loss: 5.3997e-05 - mae: 0.0056 - val_loss: 3.9831e-04 - val_mae: 0.0161
Epoch 8/10
2640/2640 ━━━━━━━━━━━━━━━━━━━━ 1s 290us/step - loss: 4.7966e-05 - mae: 0.0053 - val_loss: 3.8988e-04 - val_mae: 0.0144
Epoch 9/10
2640/2640 ━━━━━━━━━━━━━━━━━━━━ 1s 274us/step - loss: 4.9708e-05 - mae: 0.0053 - val_loss: 2.0086e-04 - val_mae: 0.0116
Epoch 10/10
2640/2640 ━━━━━━━━━━━━━━━━━━━━ 1s 279us/step - loss: 4.7215e-05 - mae: 0.0050 - val_loss: 3.4308e-04 - val_mae: 0.0152
```

Model evaluation

```
# Evaluate the model
mse_custom, mae_custom = model_custom.evaluate(X_test, y_test, verbose=0)

# Output the results
print("Custom Model - Mean Absolute Error (MAE): %.5f" % mae_custom)
print("Custom Model - Mean Squared Error (MSE): %.5f" % mse_custom)
```

[50] 0.2s Python

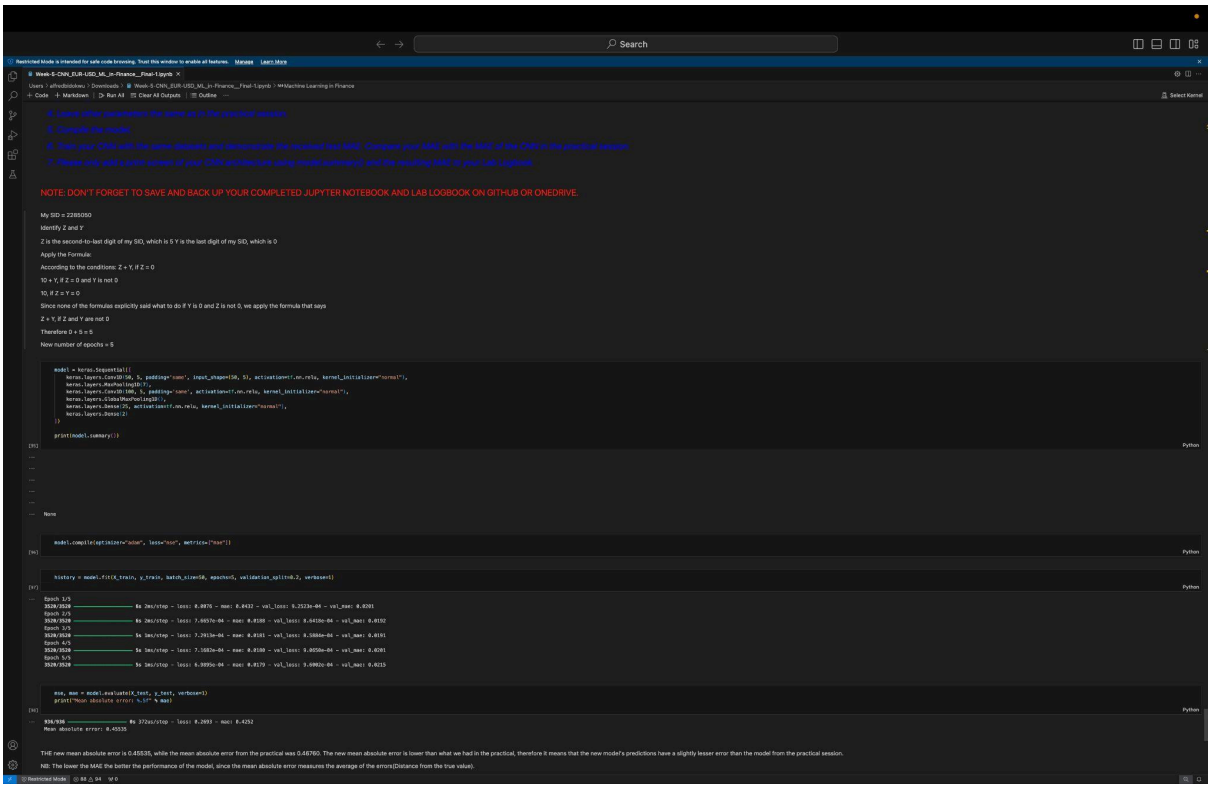
```
Custom Model - Mean Absolute Error (MAE): 0.04276
Custom Model - Mean Squared Error (MSE): 0.00219
```

MAE in the practical: Mean absolute error: 0.01778
MAE of my own model: Custom Model - Mean Absolute Error (MAE): 0.04276

The MAE of my own model is 0.04276 which is slightly higher than the MAE of the practical session which was 0.01778

A lower MAE is better and more preferable because a lower MAE means that, on average, the model's predictions are closer to the true values, indicating a more accurate model.

Lab 5



4. Leave other parameters the same as in the practical session.
5. Compile the model.
6. Train your CNN with the same datasets and demonstrate the required test MAE. Compare your MAE with the MAE of the CNN in the practical session.
7. Please only add a code screen of your CNN architecture using model.summary() and the resulting MAE to your Lab Logbook.

NOTE: DON'T FORGET TO SAVE AND BACK UP YOUR COMPLETED JUPYTER NOTEBOOK AND LAB LOGBOOK ON GITHUB OR ONEDRIVE.

My SID = 2285050

Identify Z and Y

Z is the second-to-last digit of my SID, which is 5 Y is the last digit of my SID, which is 0

Apply the Formula:

According to the conditions: Z + Y, if Z = 0

10 + Y, if Z = 0 and Y is not 0

10, if Z = Y = 0

Since none of the formulas explicitly said what to do if Y is 0 and Z is not 0, we apply the formula that says

Z + Y, if Z and Y are not 0

Therefore 0 + 5 = 5

New number of epochs = 5

```
model = keras.Sequential([
    keras.layers.Conv1D(50, 5, padding='same', input_shape=(50, 5), activation=tf.nn.relu, kernel_initializer="normal"),
    keras.layers.MaxPooling1D(2),
    keras.layers.Conv1D(100, 5, padding='same', activation=tf.nn.relu, kernel_initializer="normal"),
    keras.layers.GlobalMaxPooling1D(),
    keras.layers.Dense(25, activation=tf.nn.relu, kernel_initializer="normal"),
    keras.layers.Dense(2)
])

print(model.summary())
```

[81] Python

None

```
model.compile(optimizer="adam", loss="mse", metrics=["mae"])
```

[84] Python

```
history = model.fit(X_train, y_train, batch_size=50, epochs=5, validation_split=0.2, verbose=1)
```

[87] Python

```
Epoch 1/5
2520/2520 ━━━━━━━━━━━━━━━━━━━━ 8s 2ms/step - loss: 0.0076 - mae: 0.0432 - val_loss: 9.2523e-04 - val_mae: 0.0201
Epoch 2/5
2520/2520 ━━━━━━━━━━━━━━━━━━━━ 6s 2ms/step - loss: 7.0657e-04 - mae: 0.0188 - val_loss: 8.6410e-04 - val_mae: 0.0192
Epoch 3/5
2520/2520 ━━━━━━━━━━━━━━━━━━━━ 5s 1ms/step - loss: 7.3913e-04 - mae: 0.0181 - val_loss: 8.5886e-04 - val_mae: 0.0191
Epoch 4/5
2520/2520 ━━━━━━━━━━━━━━━━━━━━ 5s 1ms/step - loss: 7.5583e-04 - mae: 0.0180 - val_loss: 9.0950e-04 - val_mae: 0.0201
Epoch 5/5
2520/2520 ━━━━━━━━━━━━━━━━━━━━ 5s 1ms/step - loss: 6.3095e-04 - mae: 0.0179 - val_loss: 9.6902e-04 - val_mae: 0.0215
```

```
mse, mae = model.evaluate(X_test, y_test, verbose=1)
print("Mean absolute error: %.5f" % mae)
```

[88] Python

```
936/936 ━━━━━━━━━━━━━━━━━━━━ 0s 372us/step - loss: 0.2693 - mae: 0.4252
Mean absolute error: 0.45535
```

THE new mean absolute error is 0.45535, while the mean absolute error from the practical was 0.46760. The new mean absolute error is lower than what we had in the practical, therefore it means that the new model's predictions have a slightly lesser error than the model from the practical session.

NB: The lower the MAE the better the performance of the model, since the mean absolute error measures the average of the errors(Distance from the true value).

Lab 6

Lab 7

Lab 8

Lab 9

Lab 10

Lab 11

Lab 12